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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,320	11/19/2003	Chunyuan Chao	M-15208 US	1058
32605	7590	05/19/2006	EXAMINER	
MACPHERSON KWOK CHEN & HEID LLP 1762 TECHNOLOGY DRIVE, SUITE 226 SAN JOSE, CA 95110			DEO, DUY VU NGUYEN	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 05/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/718,320

Applicant(s)

CHAO ET AL.

Examiner

DuyVu n. Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 and 34-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 11-26 and 34-37 is/are rejected.
- 7) ☒ Claim(s) 4-10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3, 13-17, 21, 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Tsai et al. (US 5,753,418).

Tsai describes a method for forming a pattern layer comprising: providing an organic ARC 16 on a silicon nitride layer 14 (claimed the material of ILD) (col. 6, line 25-50); providing a photoresist pattern (claimed organic photoresist) layer including a plurality of first openings on the organic ARC layer (col. 6, line 65-24); etching the organic ARC layer to form a plurality of second openings extending through the ARC layer, wherein the second openings having inwardly-tapered sidewalls such that the bottom width dimensions of the second openings are smaller than corresponding width dimensions of the first openings (col. 7, line 25-40); etching the nitride layer to form a plurality of third openings from the second openings (col. 8, line 18-30).

Referring to claim 3 the CF₄ would provide etch inhibitors in order to form a taper sidewall in the organic ARC.

Referring to claims 13-15, the openings (claimed second openings) in the organic ARC layer has an angle of 75-85 degrees, as taught by Tsai (col. 7, line 39, 40) (this would provide claimed the slopes to be at least 4 or more degrees away from the 90 degree vertical slop, or

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about 7-40 degrees away from a 90 degree vertical slope, or 7-22 degrees away from a 90 degree vertical slope.)

Referring to claim 16, figure 3 shows the contact hole 18 must be anisotropically etched in order to form a straight and vertical sidewalls (claimed the sidewalls of the third openings are not sloped by more than about 3 degrees away from the 90 degree vertical slope).

Referring to claim 17, the etching of the nitride layer (claimed third opening) uses CF₄, CHF₃ (claimed carbon and fluorine providing components) and helium (claimed inert gas) (col. 8, line 33-50).

Referring to claims 21, 22, the opening in the nitride would have a width of 0.3 um (col. 8, line 17), which would be at least 10% smaller than the corresponding width dimension of the first opening of 0.35 um.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-3, 11-16, 21-26, 34, 35, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hui et al. (US 6,514,868) and Tsai et al. (US 5,753,418).

Hui describes a method for forming contact hole comprising: providing an silicon nitride ARC 26 (claimed ARC) on an silicon dioxide ILD layer 14 (col. 3, line 29, 30, 50-62); providing a photoresist pattern (claimed organic photoresist) layer including a plurality of first openings on

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the ARC layer (col. 3, line 55-57); etching the ARC layer to form a plurality of second openings extending through the ARC layer, wherein the second openings having inwardly-tapered sidewalls such that the bottom width dimensions of the second openings are smaller than corresponding width dimensions of the first openings (col. 3, line 63-col. 4, line 17); etching the silicon dioxide ILD layer to form a plurality of third openings from the second openings (col. 4, line 18-28). Unlike claimed invention, Hui doesn't describe the ARC is an organic ARC.

However, at the time of the invention, organic ARC has been known and used by one skilled in the art as shown here by Tsai. Tsai describes using an organic ARC wherein the organic ARC is etched with CF₄ and Ar to form a tapered organic ARC (col. 6, line 44-65). One skilled in the art, at the time of the invention was made, would find it obvious to use any other ARC including organic ARC taught by Tsai because Hui teaches that the ARC can be any other suitable material having reflective properties. Using this organic ARC would provide a tapered organic ARC for the etching of the contact hole with a reasonable expectation of success.

Referring to claims 3, 35, the CF₄ would provide etch inhibitors in order to form a taper sidewall in the organic ARC.

Referring to claims 16 and 34, figure 1 in Hui shows the contact hole 18 must be anisotropically etched in order to form a straight and vertical sidewalls (claimed the sidewalls of the third openings are not sloped by more than about 3 degrees away from the 90 degree vertical slope.) The method further comprises an electrical conductor such as W (claimed refractory metal) (col. 3, line 33-37).

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Referring to claims 21, 22, Hui describes the contact hole has a CD including 1000 angstrom, which is at least 10% smaller than the photoresist width of 1800 angstrom (claims 1, 4, 5).

Referring to claim 2, Hui describes the conductive material (claimed first major interconnect layer) is to contact with a gate conductor, source region, or drain region (claimed first conductive layer is part of an active layers set) (col. 3, line 33-37).

Referring to claims 11 and 12, Hui describes the critical dimension of the contact hole 18 (third openings) is from 0.16-0.18 um (claims 7, 12).

Referring to claims 13-15, the openings (claimed second openings) in the organic ARC layer has an angle of 75-85 degrees, as taught by Tsai (col. 7, line 39, 40) (this would provide claimed the slopes to be at least 4 or more degrees away from the 90 degree vertical slop, or about 7-40 degrees away from a 90 degree vertical slope, or 7-22 degrees away from a 90 degree vertical slope.)

Referring to claim 23, Hui describes the method uses photoresist pattern, which was defined by a photomask (col. 1, line 32-50).

Referring to claims 25, 26, even though Hui doesn't describe providing pattern conductive layers above the ILD regions wherein at least two of the patterned conductive layers have different plug spacing and/or different spacing between the conductive lines; however, Hui describes forming a contact hole in ILD; therefore, there must be a pattern conductive layers above the ILD regions or contact hole to provide interconnection to the lower conductive structure such as source/drain regions.

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Furthermore the spacing of the plugs or between conductive lines would obviously depend on what type of devices being manufactured. One device such as MOS-FET transistor structure, described in pages 7 and 8 of the specification, would have the patterned conductive layers with different plug spacing and/or different spacing between the conductive lines.

Therefore, one skilled in the art at the time of the invention would make the patterned conductive layers with different plug spacing and/or different spacing between the conductive lines in order to form a MOS-FET transistor structure.

5. Claims 17-20, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hui as applied to claims 1 and 34 above, and further in view of Chien et al. (US 2002/0142610).

Referring to claims 17-20, Hui doesn't describe the gas mixture, for etching the silicon dioxide layer (claimed creating the third openings), including CO, C₄F₆, Ar. Chien teaches a method for etching silicon dioxide layer using gas mixture including CO, C₄F₆, and Ar (paragraphs [0011,0041,0042]). It would have been obvious for one skilled in the art at the time of the invention to etch the silicon dioxide in light of Chien because Hui teaches that the silicon dioxide ILD can be etched by a variety of etching techniques (col. 4, line 18-22) and Chien's method would etch the silicon dioxide ILD with a high selectivity to under or over layer such as silicon nitride (claimed ARC layer) (ab.).

Referring to claim 36, Chien's gas mixture is the same as that of claimed gas mixture; therefore, the etch process would causes etch inhibitors to adhere to sidewalls of the inwardly-tapered through holes of the ARC layer.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 23-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitation “manufacturing plural monolithically integrated devices each from said predefined photomask and each having a respective version of said ILD region, of said photoresist layer and of said ARC layer with inwardly-tapered openings, but where at least two of the manufactured, monolithically integrated devices have differently dimensioned widths for their corresponding, third openings extending through their corresponding ILD regions and have differently dimensioned widths for their corresponding, second openings” is unclear. It is suggested to write the limitation in a series of concise and clear steps. Although the claims are interpreted in light of the specification, limitations from the specification (the bold bracketed and size-reduced cross-referencing text) are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Allowable Subject Matter

8. Claims 4-10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 4-10 are allowable because applied prior art doesn't teach or suggest (referring to claim 4) the creating of the second openings in the organic ARC using a reactive ion plasma

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having a carbohydrate-providing component, a fluorine-providing component, and an inert bombardment component. Tsai describes the gas mixture of CF₄, which would be a fluorine-providing component and Ar, an inert bombardment component.

Response to Arguments

9. Applicant's arguments with respect to claims 1-26, 34-37 have been considered but are moot in view of the new ground(s) of rejection.

10. Referring applicant's argument that the examiner and one skilled in the art would understand claims 23-26 in light of the specification is acknowledged. However, although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6 am -2:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner
Duy-Vu N Deo
5/15/06

